

PATENT

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APPLICATION  
FOR UNITED STATES LETTERS PATENT  
for

UPS CABINET AND METHOD OF ASSEMBLY

by

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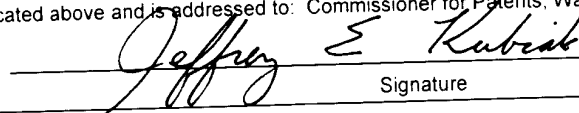
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## BACKGROUND OF THE INVENTION

### CROSS-REFERENCE TO RELATED APPLICATIONS

- 5 1. This application claims the benefit of the Provisional Application Serial No. 60/243,998 filed October 27, 2000.

#### 2. Field of the Invention

10 The present invention relates generally to an uninterruptible power supply (UPS) and, more particularly to a cabinet containing an uninterruptible power supply.

#### 3. Relation to Prior Art

AC commercial power is used as a primary power source for computers and other data processing equipment that in turn use stored program and solid state technology. These circuits are generally very sensitive to input power variations from a desired standard waveform. However, commercial AC power waveforms are subject to many variations due to the demands of other users on the power line and other factors. Typical undesirable variations are over-voltage, under-voltage, voltage outages and signal transients. Undesirable variations also occur due to load conditions, as well as line conditions.

20 Typically, UPS's include a battery backup as a secondary or reserve power source, which is activated to supply power to the load upon total failure of the commercial power or significant degradation of the primary power source. A power inverter is used in the UPS to convert the DC power delivered by the batteries into AC power.

25 FIG. 1 shows a conventional, prior art cabinet arrangement for a UPS. The UPS has a cabinet 10. The cabinet has a plurality of bus bars 20 for connection to a load, such as a computer network (not shown). Typically, the magnetic components 30 for the UPS, such as transformers, autotransformers and inductors, are located in a lower portion or bottom of the cabinet. Separate cabinets are frequently used to hold other magnetic components, such as input transformers and bypass inductors (not shown). Capacitor

assemblies 40 are typically above magnetic components 30 in cabinet 10. Power hardware electronics and controls 50, such as inverters and rectifiers, then lie above the magnetic components and the capacitor assembly.

5 In the typical UPS cabinet, the magnetic components 30 are first to be placed into the cabinet during assembly. Because magnetic components 30 are voltage specific, the installation of the magnetic components determines the voltage rating of the UPS unit. Because the electronic components are typically the same for multiple voltage configurations, it would be desirable to have a UPS cabinet in which the magnetic components could be installed as a last step of the manufacturing process.

10 The present invention is directed to overcoming, or at least reducing the effects of, one or more of the problems set forth above.

## SUMMARY OF THE INVENTION

In view of the foregoing and other considerations, the present invention relates to a cabinet containing an uninterruptible power supply.

5 In accordance with one aspect of the present invention, there is provided a method of assembling an uninterruptible power supply. An initial step includes assembling a frame defining three portions. A plurality of bus bars install in a first portion of the frame. The bus bars are accessible through the first portion of the cabinet. A capacitor assembly installs in a second portion of the frame. A power assembly also installs in the  
10 second portion. The power assembly is accessible through the second portion. A power electronic component panel mounts in the second portion. A control panel mounts adjacent to the power electronic components in the second portion. The control panel is accessible through the second portion. A plurality of magnetic components install in a third portion of the frame. The plurality of magnetic components are accessible through  
15 the third portion of the cabinet.

## BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing, preferred embodiment and other aspects of the present invention will be best understood with reference to a detailed description of specific embodiments of the invention, which follows, when read in conjunction with the accompanying drawings, in which:

FIG. 1 illustrates a conventional cabinet arrangement for an uninterruptible power supply (UPS) as evidenced in the prior art.

FIG. 2 illustrates an isometric view of a frame for an UPS cabinet according to the present invention.

FIG. 3 illustrates another isometric view of the UPS cabinet with the bus bars installed.

FIG. 4 illustrates the isometric view of the UPS cabinet with the capacitor assemblies and power DC Link installed.

FIG. 5A illustrates the isometric view of the UPS cabinet with the power electronics installed.

FIG. 5B illustrates the isometric view of the power electronics.

FIG. 6 illustrates the isometric view of the UPS cabinet with the control panel installed.

FIG. 7 illustrates an isometric view of the back of the UPS cabinet with the magnetic components installed.

FIG. 8 illustrates the UPS cabinet after final assembly.

While the invention is susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, it should be understood that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modification, equivalents and alternatives falling within the scope of the invention as defined by the appended claims.

## DETAILED DESCRIPTION OF THE INVENTION

FIG. 2 illustrates an isometric view of a frame **100** for an UPS cabinet according to the present invention. Components of frame **100** may be of galvanized metal and are attached by pop rivets **101**. Pop-riveted construction allows the cabinet components to be shipped flat. Frame **100** has a base **102**. The base has a plurality of casters **104** and stands **106**. During assembly of the cabinet, a plurality of posts **107** connects to the corners of base **102** and support ceiling **110**. Ceiling **110** may have an opening **111** for locating a cooling unit or fans (not shown) in the top of frame **100**.

A dividing wall **112** also connects to base **102** and ceiling **110** of frame **100**. A post **108** on the side of the frame and opposing post **109** on dividing wall **112** separate the cabinet into a front portion **120** and a back portion **122**. A bus bar portion **124** lies on the other side of dividing wall **112**. Dividing wall **112** has a series of access or conduit openings **114** for connection of electronics in back portion **122** to the bus portion **124**.

FIG. 3 illustrates another isometric view of the UPS cabinet during the process of assembly. With frame **100** assembled as shown in FIG. 3, bus bars **130** are installed on dividing wall **112** on the side of bus bar portion **124**. Bus bars **130** have a bar **132** mounted on dividing wall **112** by insulator **134**.

FIG. 4 illustrates an isometric view of the UPS cabinet and frame **100** in a next step of assembly. Capacitor assemblies **140**, **142** and power DC link **150** install in front portion **120** of the cabinet. A first capacitor assembly **140** contains a plurality of capacitors arranged in a matrix. First capacitor assembly **140** connects to base **102** and post **108** in front portion **120** of the cabinet. A second capacitor assembly **142** fits above first capacitor assembly **140** and to post **108**. Capacitor sub-assembly components **144** are connected as well.

In front portion **120**, power DC Link **150** connects to base **102** near the front the cabinet. Full access to power DC Link **150** can be achieved from the front of the cabinet allowing servicing and maintenance from the front of the cabinet. Power DC Link **150** contains components, such as capacitors, necessary for connecting the UPS to the battery power supply. A control switch **154** for setting operation or service modes installs in front portion **120** for front accessibility as well.

FIG. 5A illustrates the isometric view of the UPS cabinet in a next stage of assembly. Power electronic components **160** install in front portion **120**. Power electronic components **160**, such as rectifiers and inverters mount to panel **162**. Panel **162** attaches to side post **108** and **109** and fits above capacitor assemblies **140**, **142**. A fan unit **164** may be further provided on panel **162** to cool the electronic components and draw air from the front of the cabinet.

Referring to the detail of power electronic components **160** in FIG. 5B, panel **162** has hooks **166** and **168** on one edge and additional hooks (not shown) on the opposite edge. The hooks allow the panel to be prefabricated and connected to the posts as shown in FIG. 5A. Panel **162** can be assembled independently of the frame. The power electronic components may be used with various voltage configurations and lends themselves well to a modular panel. Panel **162** with power electronic components **160** simply sets in the UPS cabinet during manufacture.

Having power electronic components **160** on panel **162** offers a manufacturing advantage due to the modular design of the power electronics on the panel. Connections such as connection **178** and wires **176** visible in FIG. 5B project through panel **162** and into rear portion **122** keeping high voltage connections in the back portion of the cabinet.

FIG. 6 illustrates the isometric view of the UPS cabinet in a following step of assembly. A control panel **180** installs in front portion **120**. Control panel **180** attaches to the front of the frame and connects to corner post **107** and dividing wall **112**. The control panel may attach by hinges. No high voltage is accessible on control panel **180**, so as not to expose personnel accessing the UPS from the front of the unit to high voltage connections or components.

FIG. 7 illustrates an isometric view of the back of the UPS cabinet. Magnetic components **200** install in rear portion **122** of frame **100**. Adding magnetic components **200** as a final step of the assembly of the cabinet allows the UPS to be configured for a specific voltage selection. Because the magnetic components determine the voltage rating of the UPS, other components of the assembly, such as the capacitor assemblies, power electronic components and control door may be mass produced independently of the cabinet. Adding the magnetic components as a final step provides the opportunity

during manufacture to tailor assembly of the UPS cabinet to specific client needs or pending orders.

Transformers stack on three tiers **210**, **212** and **214** that form racks from base **102** to ceiling **210** in back portion **122**. In the present embodiment, access to the three tiers for magnetic components **200** can be achieved from the back of the cabinet. In this way, magnetic components **200** can be installed last in the assembly of the UPS. Having the ability to install magnetic components **200** near the end of assembly allows the UPS to be configured for various voltage ratings.

First tier **210** includes a rack that holds an output transformer **220**. Second tier **212** includes a rack that holds an input autotransformer **230**. Third tier **214** includes a rack that holds a bypass autotransformer **240**. Additionally, a series of inductor and filter racks **250**, **252**, **254** and **256** install in back portion **122** of frame **100**. These racks also have rear accessibility. Rack **250** holds a plurality of input inductors **260**. Rack **252** holds a plurality of output inductors **270**. Rack **254** may also hold a plurality of inductors used in an input filter, and rack **256** may hold other optional components. The arrangement of tiers **210-214** in rear portion **120** allows bypass transformer **240** and input transformer **230** to be included in the cabinet, which may not be available in conventional UPS cabinets.

FIG. **8** illustrates the UPS cabinet after final assembly. Frame **100** of the UPS cabinet has been fitted with a cover door **300**. Hinges **302**, **304** affix door **300** to the frame. Hinges **302**, **304** allow door **300** to be removed during maintenance procedures. Additionally, the hinges may be used is either a left or right hand arrangement for opening the door. A fan unit **306** having a plurality of fans and a protective screen installs in the top of the frame.

Protective and cosmetic panels may be added to the sides and rear of the frame. In FIG. **8**, the left side of the UPS has a protective panel or bulkhead **310** added. Corner posts **107** and dividing post **108** are partially exposed. Unlike a cosmetic panel that covers the entire side of the cabinet, bulkhead **310** allows for attachment of another cabinet (not shown) to the frame of the UPS.



Specifically, corner posts **107** have a plurality of boltholes **312** along their length that align with boltholes in an adjacent frame of an ancillary cabinet. Bolts (not shown) attach the ancillary cabinet to the UPS frame. Bulkhead **310** provides an interior barrier between the adjoined cabinets and has a wiring conduit **320** for passage of wires (not shown) between the adjoined cabinets.

While the invention has been described with reference to the preferred embodiments, obvious modifications and alterations are possible by those skilled in the related art. Therefore, it is intended that the invention include all such modifications and alterations to the full extent that they come within the scope of the following claims or the equivalents thereof.